This draft, August 31, 2000, prepared by DP-21, has not been approved and is subject to modification.
Project No. SAFT-0074

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DOE-STD-3015-YR
PROPOSED

Superseding
DOE-STD-3015-97

DOE STANDARD

NUCLEAR EXPLOSIVE SAFETY STUDY PROCESS

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

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FOREWORD

This Department of Energy (DOE) Standard is approved by the Assistant Deputy Administrator for Military Application and Stockpile Operations, National Nuclear Security Administration (NNSA), and is available for use with DOE O 452.2B, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS, by all DOE and NNSA components and their contractors who are responsible for the nuclear explosive operations and associated activities and facilities.

Standards are used to identify methods that DOE and NNSA find acceptable for implementing the Department's requirements. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to:

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All DOE nuclear explosive operations require a Nuclear Explosive Safety Study as set forth in DOE O 452.2B. This Technical Standard provides requirements and guidance for the Nuclear Explosive Safety Study Process.

DOE technical standards, such as this standard, do not establish requirements. However, all or part of the provisions in a DOE standard can become requirements under the following circumstances:

(1) they are explicitly stated to be requirements in a DOE requirements documents; or

(2) the organization makes a commitment to meet a standard in a contract or in an implementation plan or program required by a DOE requirements document.

Throughout this standard, the word “shall” is used to denote actions that must be performed if the objectives of this standard are to be met. If the provisions are made requirements through one of the two ways discussed above, then the word “shall” statements would become requirements. If it is not appropriate to consider that “should” statements would automatically be converted to “shall” statement as this action would violate the consensus process used to approve this standard.

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1. PURPOSE

This Technical Standard provides specific requirements and guidance for nuclear explosive safety (NES) studies, and surveys in accordance with DOE O 452.2B, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS.

2. SCOPE

This Technical Standard describes the responsibilities and procedures for the NES study process. This Standard does not apply to response to unplanned events (e.g., Accident Response Group activities), which are addressed in DOE 5300-series Orders and DOE O 151.1, COMPREHENSIVE EMERGENCY MANAGEMENT SYSTEM. DOE O 452.2B defines the boundaries between planned and unplanned events which may require a different approach for a NES evaluation.

3. BACKGROUND

Nuclear explosives by their design and intended use require collocation of high explosives and fissile material. The design agencies are responsible for designing safety into the nuclear explosive. The design and production agencies are responsible for designing safety into processes involving the nuclear explosive, including considerations of facility interfaces. In addition, safety is assured through comprehensive, independent safety reviews involving the DOE and NNSA national laboratories, Operations Offices, Headquarters, and applicable Area Offices and operating contractors with expertise in nuclear explosive safety.

The Nuclear Explosive Safety Study Group (NESSG) evaluates nuclear explosive operations against the Nuclear Explosive Safety Standards specified in DOE O 452.2B using systematic evaluation techniques. These Safety Standards must be satisfied for nuclear explosive operations.

4. RESPONSIBILITIES

1. Assistant Deputy Administrator for Military Application and Stockpile Operations (DP-20) shall:

(1) Ensure NNSA/HQ personnel meet the qualification requirements for NESSG Members delineated in Appendix A of this Standard prior to being assigned as a member to a NESSG.

(2) Approve NES Study Reports.

b. Managers, NNSA Operations Offices, as appropriate, shall:

(1) Recruit four personnel to serve as senior NESSG members.

(2) Implement a special orientation program for new NESSG members.

(3) Ensure operation office personnel meet the applicable qualifications (member, chairman, or senior member) delineated in this Standard prior to being assigned to a NESSG.

(4) Appoint a NNSA employee as Chairperson of a specific NESSG.

(5) Approve the proposed membership list for each NESSG.

(6) Schedule NESSG activities.

(7) Ensure that each NESSG has sufficient technical, administrative, and logistical resources.

(8) Evaluate NESSG reports, and make appropriate recommendations to DP-20.

(9) Provide copies of approved NES Survey and NES Performance Review reports to DP-20.

(10) Ensure appropriate action is taken on approved NESSG findings .

c. Operations Office NESSG Chairperson shall:

(1) Organize, convene, and conduct the NESSG.

(2) Compile and forward the NESSG Report, or NES Performance Review report to the manager of the Operations Office.

(3) Suspend an NESSG activity, if unable to fulfill the requirements of DOE O 452.2B and this Standard..

d. NNSA Management & Operating (M&O) Contractor and Design Agencies shall:

(1) Provide input documentation, briefings, and demonstrations to the NESSG, as required.

(2) Certify the accuracy of input documentation they provide.

(3) Ensure their personnel meet the qualification requirements for NESSG Members delineated in this Standard prior to being assigned as a NESSG member.

(4) Provide qualified technical advisors to support NESSG activities.

(5) Take appropriate action on approved NESSG findings for which they have responsibility.

(6) Provide NESSG member training support.

5. OBJECTIVES

The objective of a NES Study and other NES evaluations is to evaluate nuclear explosive operations to assess the adequacy of controls to meet the Nuclear Explosive Safety Standards.

a. A NES Study shall be performed:

(1) For all proposed nuclear explosive operations.

(2) When determined to be necessary by the nuclear explosive operations change control process. .

(3) When determined to be necessary by a NES Survey or Performance Review.

b. A NES Survey may be performed for a proposed operation that is similar to an operation studied previously and for which a current and approved NES Study Report exists. The initial determination will be made by the cognizant Operations Office.

c. A NES Performance Review shall be conducted once every 36 to 48 months for all programs, processes, or activities for which a NES Study without an expiration date, was approved in accordance with DOE O 452.2B.

6. NESSG PERSONNEL REQUIREMENTS

6.1 NESSG COMPOSITION

a. The objective of the nomination and approval process is to ensure an acceptable mix of NESSG members. The NESSG should collectively provide the diversity of thought, continuity, experience and group dynamics to effectively evaluate specific operations. No organization will have more than one NESSG member (excluding senior members) per review, and no member will be assigned solely to represent an organization. The members of each NESSG will be nominated by the NESSG Chairman in coordination with the member's organizations, and approved by the operations office manager.

NESSG size will be scoped to the number needed for an effective review of the topic at hand. The core NESSG is:

– One chairperson (responsible operations office for the nuclear explosive activity);

- Two senior members
- One Sandia National Laboratory member
- One Lawrence Livermore National Laboratory member.
- One Los Alamos National Laboratory member.
- One Pantex Plant M&O Contractor for NESSs at the Pantex Plant.

If a larger NESSG membership is desired, it will be assembled around the core members.

Additional NESSG members can be drawn from the following organizations with NES responsibilities:

Federal Government
Albuquerque Operations Office
Amarillo Area
Nevada Operations Office
Oakland Operations Office
DOE/NSSA Headquarters-Director, Office of Nuclear Weapons Surety

National Laboratories and Contractors
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
Sandia National Laboratory
Pantex Plant Management and Operating contractor

b. NESSG members for a specific study, survey, or NES performance review should not be changed for its duration.

6.2 NESSG MEMBER QUALIFICATION REQUIREMENTS

To support the NESSG mission and desired group characteristics, individual members must qualify by technical ability, independence, and temperament. The requirements for technical background, knowledge, and independence are outlined in section 6.6 and Appendix A of this Standard.

A key qualification is the ability to apply NES expertise in evaluating nuclear explosive operations (NEOs). NESSG members must have the ability and willingness to question and challenge the line

management safety statement, line of logic, and justification for all issues with the potential to impact NES. Members must be able and willing to actively participate as part of a team, and to take an unpopular stand when warranted. They also need the oral communication skills to participate effectively in deliberations, and the written communication skills to clearly document findings.

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Four senior NESSG members will be recruited based on their background and experience. Senior members shall meet the requirements delineated in Appendix A of this Standard and be certified by the AL Operations Office Manager prior to being assigned as a member to a NESSG.

6.3 TECHNICAL ADVISORS TO THE NESSG

The NESSG may use experts (non-voting participants) in specific technical disciplines to provide technical advice in their specialty as it relates to the specific nuclear explosive operation. Advisors in risk assessment; environment, safety, and health; security; use control; mechanical design; electrical design; one-point safety; high explosives; and other disciplines may be required, as determined by the NESSG chairperson. Advisors should meet the same criteria for independence as members. Advisors for a specific NES study or survey should not be changed for its duration.

6.4 NESSG MEMBER TRAINING PROGRAM

a. Organizations providing NESSG members shall ensure all NESSG members meet the qualification requirements delineated in this Standard.

b A mentoring or intern program should be established to provide new personnel the opportunity to gain the necessary background and knowledge from experienced personnel. Details and special assignments should also be considered to enhance knowledge and experience.

c. A special orientation program shall be developed for senior members

6.5 NESSG MEMBER CERTIFICATION

a. Management at NESSG member organizations will certify each of their NESSG members' abilities to participate as a productive NES study member. This certification will be based on the individual satisfying the qualification requirements delineated in this Standard. Certification shall be in the form of a certification letter to the appropriate operations office that is reviewed and updated as required.

b. Certification is valid for one year, and must be current for all NESSG members at the time the NESSG convenes.

c. Certifying authorities shall be designated by:

(1) DP-20.

(2) Operations Office managers.

(3) Area Office managers.

(4) Laboratory directors.

(5) M&O Contractor managers.

6.6 NESSG MEMBER INDEPENDENCE

NESSG members shall not have current responsibility for the design, development, production, or testing of the specific nuclear explosive or operation being evaluated. Members shall not participate in the preparation of the input documentation or in the preparation or presentation of briefings. Members shall make unbiased and independent judgments regarding the nuclear explosive safety of the system, operation, or process under consideration. Members shall not have responsibility for advocacy of special interests of any organization, including their own.

7.0 NES STUDY PROCESS

7.1 PLANNING MEETING

The cognizant Operations Office shall conduct a planning meeting with the principal participants (appropriate Operations Office organizations, design agency, production agency, and Area Office, as needed). The purpose of the planning meeting is to define the scope and objectives of the NES Study; identify required input document contents; assign organizational responsibilities for input document preparation; develop a schedule for input document preparation and submission; identify organizational points of contact; and plan briefings, demonstrations, and resources as required to support the study. This information shall be documented and distributed to appropriate agencies and personnel.

7.2 NESSG MEMBER AND ADVISOR PREPARATION

NESSG members and advisors are responsible for reviewing input documentation prior to commencing the study. Members and advisors shall be given sufficient time and resources to read and evaluate the input documentation, references, and applicable Master Studies prior to the start of the study. The NESSG Chairperson shall schedule an input document adequacy review approximately 5-10 working days after receipt of the input document. Each member and each advisor shall provide an initial judgement of the adequacy of the input document to conduct the study. The NESSG shall document, to the preparing organizations, the need for any additional information or clarification.

After the NESSG judges the input document to be adequate, the NESSG shall coordinate with the Project Team to schedule the NES Study. Normally, the time needed to prepare for a NES Study is 15-20 working days after completion of the adequacy review. This period is for the members and advisors to perform a detailed review of the input document in preparation for the NES Study and for any additional preparation by the Project Team.

The above time frames are provided as general guidance. For specific NES studies, the time frames may differ depending on the scope and complexity of the study.

Preparation for, and conduct of, a NES Study shall be the primary responsibility of the designated NESSG members and advisors for the duration required to support a specific NES Study. Conflicts shall be resolved in favor of NESSG duties from the date the input document is scheduled to arrive until conclusion of the NES Study. However, individual technical advisors may be released early upon unanimous agreement by the NESSG members.

7.3 STUDY ELEMENTS

The following elements of nuclear explosive safety shall be considered in the NES Study, if applicable to the operation:

a. Isolation of nuclear explosives from unwanted energy sources. This includes but is not limited to electrical, thermal, mechanical, and chemical energy sources.

b. One-point safety.

c. High explosive safety.

d. Design safety features.

e. The nuclear explosive safety theme.

f. Electrical tester design and safety including the interface between the tester and the nuclear explosive.

g. Design, safety, and use of materials, tooling, and mechanical and electrical equipment.

h. The adequacy of written procedures for the safe conduct of the operation.

i. The threat to nuclear explosive safety from human error.

j. Potential threats to nuclear explosive safety from security operations.

k. The safety of the equipment and procedures for transporting nuclear explosives.

l. Potential threats to nuclear explosive safety from associated systems (e.g., spin or rocket motors, parachute deployment systems, use control features, and instrumentation for nuclear explosive test devices).

m. Other potential threats to nuclear explosive safety particular to the operation (e.g., high explosive dissolution process, command disablement tests, accelerated aging tests, and separation system tests).

7.4 MASTER NES STUDIES AND OPERATION-SPECIFIC NES STUDIES

There are two types of NES studies: Master Studies and operation-specific studies. NES Master Studies evaluate processes, facilities, equipment and tooling, and management systems that are common to many nuclear explosive operations. Operation-specific NES Studies include the interfaces with applicable Master Studies and other studies. Operations Offices shall determine the scope of Master Studies appropriate for their operations. The following are examples of Master Studies:

a. Over-the-Road Transportation. Reviews of all DOE nuclear explosive offsite transportation operations. This study includes evaluation of equipment and procedures to accomplish this task and potential threats to nuclear explosive safety from the associated security operations (not security adequacy).

b. Electrical Equipment Control Program. Reviews of the design process, control, calibration, and maintenance of electrical equipment used during nuclear explosive operations.

c. Assembly, Storage, and Transportation. Reviews of the assembly and disassembly of generic nuclear explosive test devices; design, control, and maintenance of facilities and common equipment; storage of components and assembled devices; and onsite transport of the test device.

d. Security Master Study. Reviews of security operations for potential threats to nuclear explosive safety. The NESSG does not evaluate the adequacy of security measures. Security adequacy is assessed through other processes.

e. Installation and Emplacement. Reviews of the installation of the test device in the test canister/rack and the emplacement at the test location.

f. Arming & Firing, Timing & Control. Reviews of the design process, control, calibration, operation, and maintenance of facilities and equipment used to accomplish detonation of nuclear explosive test devices.

7.5 NES STUDY INPUT DOCUMENTS

Input documentation shall include detailed information and analysis. A designated agency shall compile all input information into an integrated document and ensure delivery to the NESSG members and technical advisors. The Planning Meeting shall determine the technical information required. The following are examples of topics that should be addressed, if applicable to the specific study:

a. One-point safety analysis including a summary of test results, if available.

b. A description of the nuclear explosive including non-DOE supplied components, when these components are a part of the nuclear explosive while it is in DOE custody.

c. Nuclear explosive safety theme and description of the nuclear explosive design safety features.

d. A description and process flow of the proposed nuclear explosive operation.

e. The nuclear explosive hazards assessment (e.g., Hazards Analysis Report (HAR) and safety controls documentation) for the specific nuclear explosive operation.

f. Onsite and offsite transportation tie-down requirements and analysis/testing.

g. Recommended specific nuclear explosive safety rules (NESRs).

h. Identification of controls and supporting rationale with analysis and/or test data, as applicable.

i. Recommended immediate-action procedures.

j. Analysis of electrical circuits in the nuclear explosive.

k. Description of electrical test equipment and interface connections.

l. Characteristics of electro-explosive devices.

m. Description of tooling and equipment.

n. Description of telemetry hazards.

o. Description of electromagnetic radiation/electromagnetic pulse susceptibilities.

p. Description of nuclear explosive shipping containers.

q. Description of any conditions unusual to the nuclear explosive or high explosive.

r. Safety considerations in surveillance evaluations and other inspection requirements.

s. Information from other applicable NES Study reports.

7.6 CONDUCTING THE NES STUDY

The NES Study process relies upon comprehensive input documentation and briefings; interaction among the NESSG, briefers, advisors, and individuals providing the demonstrations; and the NESSG deliberations to evaluate and judge the adequacy of nuclear explosive safety of the proposed operations and determine whether the proposed operations meet the Nuclear Explosive

Safety Standards. Based on this evaluation, the NESSG identifies any nuclear explosive safety concerns and writes appropriate findings.

Technical advisors to the NESSG contribute as consultants, sources of information, or participants in the evaluation. Technical advisors should participate in the evaluation of issues related to their expertise. NESSG members draw conclusions considering these evaluations and technical advice.

Demonstrations are often conducted to evaluate the nuclear explosive safety impacts of each operation. For a NES Study, demonstrations should be conducted in a manner that provides the most realistic simulation practicable. Demonstrations should be conducted as follows:

a. In an actual bay or cell representative of conditions under which the operations are to be conducted, or in a training facility set-up to accurately replicate the actual facility in size and layout. The actual bay or cell is the preferred option for demonstrations; however, if a representative or training facility is used, the accuracy of the replication will be verified.

b. By trained and qualified production technicians.

c. Employing actual or representative equipment, tools, tooling, and support equipment to the maximum extent.

d. Using mature written procedures for the operation being evaluated. Procedures shall be in a condition ready use after approval.

e. If applicable, address issues related to operations involving multiple weapons that might be collocated in the bay or cell.

7.7 NES STUDY REPORT

a. NES Study Reports shall include the NESSG conclusions and findings with supporting discussions concerning the adequacy of the controls to meet the DOE Nuclear Explosive Safety Standards of DOE Order 452.2B. The findings shall be prepared by the NESSG members, who alone will make the final determination of their content .

b. NESSG member(s) who disagree with the majority shall submit a minority opinion to the Chairperson prior to completion of the NES Study.

(1) Minority report(s) shall be included in their entirety in the NESSG report.

(2) The NESSG majority shall prepare and include an evaluation of the technical merits of the minority report(s) in the NESSG Report.

(3) The Operations Office manager shall address the minority report(s) in the endorsement letter to DP-20.

(4) DP-20 shall comment on the actions taken regarding the minority report(s) in the approval or disapproval of the NES Study Report.

c. The NESSG members shall sign the NES Study Report. Signature represents concurrence with the NESSG conclusions and findings , unless noted in minority opinion(s). Signing the report does not imply that the signer's organization with the contents. Changes made to the report after it is signed must be coordinated with the signing members.

d. The NESSG Report should contain the following information.

- Abstract
- Table of Contents
- Signature Page
- Identify input documentation
- Purpose and Background (including identification of all existing NESSG reports that are applicable to the proposed nuclear explosive operation)
- Scope (a statement that defines the proposed operations evaluated by the NESSG)

- Criteria (a general statement of the criteria used to evaluate the nuclear explosive safety of the proposed operation; e.g., the Nuclear Explosive Safety Standards)

- Activities (a statement of the activities of the NESSG and the time and place the study was conducted)

- Summary Descriptions of the Nuclear Explosive and Studied Operations

- Findings (issues and conclusions, , with supporting rationale) and summary of substantive discussions

  – Adequacy of controls to meet the DOE Nuclear Explosive Safety Standards of DOE O 452.2B.
  – Applicability of Master Studies to the proposed operations
  – Nuclear explosive safety concerns, if any
  – Identify findings that should be closed prior to start
  – Identify findings that may be deferred until after start

- Minority Report(s), if any

- References (including specific publication date, revision number, etc.)

e. Appendices:

– Appointment documentation for NESSG members and advisors
– Participants (name, organization, and function)

8. NES SURVEY PROCESS

The purpose of a NES Survey is to conduct a comparative analysis of a proposed nuclear explosive operation with an operation that is similar and documented in a NES Study Report.

The NESSG for a NES Survey shall have the same composition and personnel qualification requirements as for a NES Study. Input documents for a NES Survey shall clearly describe the

similarities and differences between the proposed operation and the operation upon which approval of the survey will be based.

The NESSG shall assess differences between the proposed operation and the approved operation to determine if process and equipment have been substantially modified. If the NESSG determines that a proposed operation is substantially different than the approved operation, a NES Study shall be performed.

9. NESSG FINDINGS

a. Operations Offices shall define a process to resolve issues identified by formal NES reviews.

b. All approved findings designated as pre-start must be closed by the cognizant Operations Office prior to commencement or continuation of operations.

c. Status reports on approved NESSG findings that require actions shall be provided quarterly to DP-20.

10. DOE APPROVAL PROCESS

The NESSG chairperson shall provide the NESSG report to the Operations Office Manager for review and action. Within 60 days, the Operations Office manager shall concur and forward the report to DP-20, or notify DP-20 of non-concurrence. The manager's endorsement letter shall contain a statement that the proposed operation meets the DOE Nuclear Explosive Safety Standards, the status and resolution plan for NESSG findings , and other appropriate recommendations the manager may have. DP-20 is the approval authority for NES Studies. Within 30 days of receipt, DP-20 shall notify the appropriate Operations Office manager of the NESSG report approval, or the reasons for its disapproval. The Operations Office manager is the approval authority for NES Surveys and Performance Reviews and shall provide copies of approved NES reports to DP-20.

Appendix A

Nuclear Explosive Safety Study Group Member Qualification Requirements

Table of Contents

1.0 INTRODUCTION

This document specifies the core set of competencies and supporting knowledge and/or skill elements that must be met to successfully complete qualification as Nuclear Explosive Safety Study Group (NESSG) Member and Chairman. Each organization should have additional requirements necessary to satisfy prior to qualifying NESSG Member/Chairman that is specific for their site. This document also contains the requirements for certifying NESSG Senior Members.

1.1 Purpose

This document establishes the Department of Energy requirements for qualifying NESSG Members, Chairmen, and Senior Members. Satisfactory and documented completion of the competency requirements and the knowledge and skill evaluation elements contained in this document ensures that the NESSG Members/Chairmen possess the minimum requisite competence (as augmented by site specific requirements) to fulfill his/her related duties and responsibilities.

1.2 Evaluation Requirements

The competency statements and supporting knowledge and/or skill evaluation elements included in this document define the minimum required knowledge and/or skill that an individual must possess to perform duties.

The competency statements may be completed through formal training, exams, self-study, and/or previous experience, training, education, or qualification.

Each organization must establish an evaluation process to determine when the candidate has acquired the competencies outlined in this document. This evaluation process shall include specific methods to document successful completion of competency statement requirements. This may include a process for documenting equivalencies (satisfy requirements through prior education, training, qualification, or experience). The following are examples of documents that may be used for this evaluation:

- Previously completed qualification
- Documented evaluation of equivalencies
- Written examination results
- Documented oral evaluation
- Documented observation of performance (initialed evaluation element and/or signed competency statement)

- Training certificates of completion
- Professional certification certificates

1.3 Final Qualification/Certification

Final qualification shall occur after all competencies have been satisfied through the evaluation process.

1.3.1 Chairman and Member Qualification. Final qualification shall consist of:

- **Comprehensive final written examination.** A comprehensive written exam shall be administered to evaluate the candidates overall knowledge. The examination will consist of questions based on a representative sample of the competency statements from this document (and site specific requirements).
- **Oral board.** An oral board shall be conducted to assess the candidate's mastery of the NES discipline, ability to communicate, and think on their feet. The board will consist of questions based on a representative sample of the competency statements from this document (and site specific requirements). (NESSG Chairman only).
- **Operations Office Manager interview.** A final interview shall be conducted by the Operations Office Manager to ensure the candidate is ready to lead reviews, and assume the duties and responsibility as a NESSG Chairman. (NESSG Chairman only).

  Following completion of the final qualification process, a senior manager designated by the applicable organization shall formally certify the individual. Certification will consist of verification that the individual has met all qualification and proficiency requirements. This certification is valid for one year, and must be current at the time an NESSG Chairman convenes an NESSG activity.

1.3.2 Senior Member Qualifications. Senior Members will be selected from private industry, the academic community, and other government agencies and have recognized superior technical backgrounds with varied experience in high-consequence operations (qualities sought after in the selection process are provided in section 1.4). These members are added to the NESSG to provide a more diversified perspective on NES Studies. Therefore, NESSG Senior Members shall have distinctly different qualification requirements than other NESSG Members and

Chairmen. Senior Members shall be provided general orientation training on nuclear explosive operations and the NES Study process prior to assignment to an NESSG. Following completion of this orientation training, the Operations Officer Manger, or designee, shall formally certify the Senior Member. This consists of verifying that the individual has met the qualification requirements. This certification is valid for one year, and must be current at the time an NESSG activity convenes.

1.4 Background and Experience

1.4.1 The minimum education and experience for NESSG Chairmen and Members is listed below.

A. Education:

Bachelor of Science degree in engineering or a related technical discipline from an accredited college or university, or equivalent and relevant on-the-job experience.

B. Experience:

Must have a minimum of five years of experience in the operation, management, or oversight, of high consequence operations (e.g., nuclear explosives, nuclear reactors, etc.)

1.4.2 NESSG Senior Members should possess the following qualities:

- Recognized senior-level scientist or engineer with broad technical and managerial experience.
- Expert knowledge of relevant technical disciplines, such as seismic phenomena, lightning, high explosives, or electrical engineering.
- Experience with the review, approval, operation, and management of high-consequence production, manufacturing, and/or power plant operations.
- Demonstrated active participation and value added in expert panels, peer reviews, etc.
- Technical investigative skills to support safety evaluations and challenge line management’s safety case.

- Upper level management experience with the ability to seek technical expertise and advice from national laboratories, industry, and/or academic communities.

1.5 Continuing Training and Proficiency Requirements

NESSG Chairmen and Members shall maintain proficiency through a continuing training program that includes the following elements:

A. Members – Participate in at least one NESSG activity every two years as an NESSG Member.

Chairmen - Lead at least one NESSG activity every two years as the NESSG Chairman.

B. Participate in informal annual NES training to cover new technical information, NES issues, lessons learned, weapon updates, and other selected refresher topics

C. Annually, complete a minimum of 24 hours of relevant technical classroom training.

The annual certification letter shall document successful completion of the above continuing training requirements in order to designate that NESSG Members/Chairmen remain proficient. For individuals unable to satisfy these requirements, a tailored requalification process shall be established.

2.0 COMPETENCIES

The following establishes the minimum core set of competencies and supporting knowledge and/or skill elements for NESSG Members and Chairmen. Those competencies applicable only to NESSG Chairman are annotated as appropriate.

2.1 Nuclear Explosive Safety Program

2.1.1 The candidate must have the ability to identify potential threats to nuclear explosive safety, and evaluate the adequacy of controls to assure nuclear explosive safety. The candidate shall be able to:

A. Evaluate nuclear detonation safety design and configuration during nuclear explosive operations including:

- Isolation:
    - Identify when barriers are breached during assembly/disassembly.
    - Identify when strong links are absent or potentially bypassed.
- Incompatibility:
    - Identify available energy sources and their effects on nuclear explosive components.
    - Identify available signals that could drive a unique signal discriminator.
- Inoperability:
    - Identify defined weak links in various nuclear explosives.
    - Describe the features and safety role of the weak link(s).

B. Evaluate the NES contributions of the design safety features of a nuclear explosive.

C. Evaluate electrical tester designs, safety analyses, and tester/nuclear explosive interfaces.

D. Evaluate special tooling and written procedures used for nuclear explosive operations.

E. Evaluate facilities and associated equipment used for nuclear explosive operations.

F. Review and understand the significance of a Safety Analysis Report (SAR), a Hazard Analysis Report (HAR), and a Nuclear Explosive Safety Study (NESS) input document (including Hazards Assessment Report) and evaluate the associated:

- Hazard analyses
- Accident analyses
- Identification of safety-class and safety-significant Structures, Systems, Components

- Derivation of Technical Safety Requirements, Operational Safety Controls, and Nuclear Explosive Safety Rules

G. Evaluate the safety analyses of nuclear explosive pre-arming, arming, timing, and firing systems and procedures.

H. Analyze security operations for potential threats to nuclear explosive safety.

I Evaluate the on-site and off-site transportation of nuclear explosives.

J. Evaluate analyses of nuclear detonation responses of nuclear explosives to an abnormal environment.

2.1.2 The candidate must have knowledge of the fission process. The candidate shall be able to:

A. Define the following terms:

- Excitation energy
- Critical energy
- Fissile material
- Fissionable material
- Fertile material

B. Describe the curve of binding energy per nucleon vs. mass number and give a qualitative description of the reasons for its shape.

C. Explain why only the heaviest nuclei are easily fissioned.

D. Explain why uranium-235 fissions with thermal neutrons, and uranium-238 fissions only with fast neutrons.

E Discuss the following processes and their application in nuclear explosive design:

- Nuclear fission
- Nuclear fusion

F. Define the term “fissile materials,” and give examples applicable to nuclear explosive design.

G. Describe the effects of each of the following on critical mass:

- Reflectors
- Absorbers

- Moderators
- Stray neutrons
- Geometry
- Poisons
- Enrichment

2.1.3 The candidate must have knowledge of the various types of radiation interaction with matter. The candidate shall be able to:

A. Describe the interactions of the following with matter:

- Alpha particle
- Beta particle
- Positron
- Neutron

B. Describe the following ways that gamma radiation interacts with matter:

- Compton scattering
- Photoelectric effect
- Pair production

2.1.4 The candidate must have knowledge of the internal design of a nuclear explosive. The candidate shall be able to:

A. Discuss the function, purpose, and design of the following systems and components:

- Arming
- Fusing
- Firing
- High explosives
- Fusionable material
- Fissile material - primary and secondary
- Detonators
- Boosting device

- Neutron generators (zippers)
- Ancillary hazardous systems

B. Describe the nuclear explosive use control features with respect to the following:

- Personnel
- Electronics
- Mechanics/required signals - PAL (permissive action link)

C. State and discuss the nuclear weapon design safety criteria from DOE O452.1B, Nuclear Explosive and Weapon Surety Program including:

- Normal environment
- Abnormal environment
- One-point safety
- Dispersal safety

D. Discuss nuclear detonation safety design principles and describe nuclear explosive components/features that have been employed to provide isolation, inoperability, and incompatibility, including:

- Barriers
- Weak links
- Strong links
- Unique signals

E Discuss the role of independence and first principles in the implementation of the nuclear detonation safety design principles (safety theme).

F. Describe nuclear explosive design features that have been employed to prevent/mitigate fissile material dispersal including:

- Insensitive high explosives
- Fire-resistant pits

2.1.5 The candidate must have knowledge of high explosives and their applicability in nuclear explosives. The candidate shall be able to:

A. Define the following terms:

- Conventional high explosives (CHE)

- Insensitive high explosive (IHE)
- One-point detonation

B. Discuss the difference between IHE and CHE used in nuclear explosives.

C. Describe the function of primary and secondary explosives in nuclear explosive design.

D. Define and compare the effects of the following interrelated high explosive terms that apply to nuclear explosive design:

- Detonations
- Violent reactions
- Deflagration
- Combustion

E. Describe the response of high explosives used in nuclear explosive design to the following external stimuli:

- Mechanical
- Electrical
- Thermal

F. Discuss the effects of aging on the high explosive materials used in nuclear explosive design.

2.1.6 The candidate must have knowledge of the effects of abnormal environments on nuclear explosives. The candidate shall be able to:

A. Define the term "abnormal environment."

B. List the categories of credible abnormal environments specific to nuclear explosive operations and storage, and describe the characteristics of each.

2.1.7 The candidate must have knowledge of the following documents related to the master tester list:

- Interagency Engineering Procedure, EP401075/A, Electrical Testers for Use with Nuclear Explosives at DOE facilities
- DG 10001, Design Guide, Electrical Testers for Use with Nuclear Explosives

(The candidate shall be able to discuss the purpose and scope of the listed documents.)

2.1.8 The candidate must have knowledge to evaluate requests for approval of changes/modifications to a nuclear explosive operation. The candidate shall be able to:

A. Evaluate requests for changes to a nuclear explosive operation.

B. List the various approval levels for changes.

C. Describe the NES Change Evaluation Process.

2.1.9 The candidate must have knowledge of the following documents:

- DOE O452.2B, Safety of Nuclear Explosives Operations
- DOE O452.1B, Nuclear Explosive and Weapons Surety Program

The candidate shall be able to:

A. Discuss the purpose and scope of the listed documents.

B. Discuss this position's roles and responsibilities regarding implementation of and compliance with the listed documents. Be able to define the following terms:

- High Explosive Deflagration
- High Explosive Detonation
- Nuclear Detonation
- Nuclear Explosive
- Nuclear Explosive Area
- Nuclear Explosive Operation
- Nuclear Explosive Safety
- Nuclear Explosive Safety Study
- Nuclear Weapon
- Personnel Assurance Program
- Surety
- Use Control

C. Discuss the purpose of the two-person concept and requirements as specified in DOE O 452.2B.

D. Discuss the general nuclear explosive safety rules established for all Department nuclear explosive operations.

2.1.10 The candidate must have knowledge of the concepts of SS-21 as contained in TBP-901. The candidate shall be able to:

A. Explain why the following are needed to ensure the safe conduct of nuclear explosive operations and associated activities:

- Strict adherence to weapon-specific nuclear explosive safety rules and nuclear explosive safety standards.
- Seamless interface with environment, safety, and health initiatives within facilities utilized to conduct nuclear explosive operations.
- Assurance of a Fail-Safe Design of nuclear explosive tooling and ergonomic nuclear explosive assembly process.
- Comprehensive tracking of procedural and design modifications to the accepted nuclear explosive design, and significant incidents identified during a nuclear explosive operation.

2.1.11 The candidate must have knowledge of DOE Nuclear Explosive Safety Standards in DOE O452.2B, Safety of Nuclear Explosive Operations. The candidate shall be able to:

A. Discuss what the focus of NES Standards is.

B. Discuss the three NES standards that all NEOs must meet as stated in DOE O452.2B, Safety of Nuclear Explosive Operations.

2.1.12 The candidate must have knowledge of DOE Nuclear Explosive-Like Assembly (NELA) requirements. The candidate shall be able to:

A. Discuss the difference between a nuclear explosive assembly and a NELA.

B. Discuss the NELA standards and specific NELA requirements stated in DOE O 452.2B.

2.1.13 The candidate must have knowledge of the general and specific Nuclear Explosive Safety Rules. The candidate shall be able to:

A. State the approval authority for exemptions from the DOE general nuclear explosive safety rules (NESRs).

B. Define the term “nuclear explosive safety rules.”

C. Discuss the different types of NESRs (DOE General, Ops Office General, Specific) and examples of each.

D. Discuss the site limitations for NEOs not known to be one-point safe.

2.1.14 The candidate must have knowledge of NES principles and technologies. The candidate shall be able to:

A. Describe the purpose and methods of isolating nuclear explosives from the facilities in which nuclear explosive operations are performed.

B. Describe the impact of nuclear explosive design safety features during the various stages of assembly/disassembly.

C. Identify circumstances that could result in unintended nuclear detonation, or high explosive detonation/deflagration in a nuclear explosive area.

2.1.15 The candidate must have knowledge of PAP described in 10 CFR 711. The candidate shall be able to:

A. Discuss the following terms as they relate to PAP:

- Nuclear explosive duty
- PAP certification
- Temporary removal
- Due process

B. Discuss the relationship between PAP certification and other job qualification requirements.

C. Identify the prerequisites for PAP certification and describe the PAP certification process.

D. Discuss the responsibilities of PAP-certified personnel and their supervisors.

E. Describe the approval process, and the notification process for the immediate temporary removal and permanent removal from the PAP.

2.1.16 The candidate must have knowledge of the NES study, NES survey, and NES Performance Review processes. The candidate shall be able to:

A. Describe the organization requirements for a NESSG.

B. Describe the scope of the NESSG responsibilities.

C. Explain the functions of an NES study, a NES survey, and NES Performance Review.

D. Discuss the requirements for conducting a NES study, NES survey, and NES Performance Review.

E. Provide examples of situations that would require a NES Study, NES Survey and NES Performance Review.

F. Describe the approval level requirements for a NES study, an NES survey, and a NES Performance Review.

G. Explain the relationship between a master study and an operation-specific study.

2.1.17 The candidate must have knowledge of the control of electrical equipment used in a nuclear explosive area (NEA). The candidate shall be able to:

A. Discuss the various types of electrical equipment that may be present in a NEA and the controls placed on them.

B. Discuss the approval process for Master Tester List (MTL) testers and Master Equipment List (MEL) equipment used at the Pantex Plant.

2.1.18 The candidate must have knowledge of tooling, testers, rigging, and hoisting equipment used for handling nuclear explosives. The candidate shall be able to:

A. Explain how the design of each of the following is important in minimizing or eliminating the potential for mishandling nuclear explosives and preventing accidents:

- Tooling
- Testers
- Rigging equipment
- Hoisting equipment

B Read and interpret design drawings and technical specifications for the tooling, testers, rigging, and hoisting equipment used in handling nuclear explosives.

C. Explain the importance of proper certification of slings and hoisting equipment used in handling nuclear explosives.

D. Explain the importance of proper certification of testers used in nuclear explosives operations.

2.1.19 The candidate must have knowledge of DOE STD 3015-YR, Nuclear Explosive Safety Study Process. The candidate shall be able to:

A. Discuss the purpose and scope of this standard.

B. Discuss this position’s roles and responsibilities regarding compliance with this standard.

2.1.20 The candidate must have knowledge of the requirements for the safe offsite and onsite transportation of nuclear explosives. The candidate shall be able to:

A. Discuss the scope and content of the applicable NES master studies that address over-the-road transportation and on-site transportation of nuclear explosives.

B. Describe hazards associated with the design and construction of vehicles authorized to transport nuclear explosives and the positive measures to control hazards.

C. Discuss the tie-down requirements for nuclear explosives during offsite and onsite transportation.

2.2 Associated Technical Areas

2.2.1 The candidate must have knowledge of the radiological and equipment hazards associated with nuclear explosives and their potential impact on NES. The candidate shall be able to:

A. Discuss the radiological characteristics and related hazards from the following materials used in nuclear explosives/weapons:

- Uranium
- Plutonium
- Tritium

B. Identify the hazards from each of the following features of nuclear explosive design:

- Spin rockets
- Retarding devices
- Pre-flight controllers
- Boosting device

2.2.2 The candidate must have knowledge of DOE Order 5480.21, Unreviewed Safety Questions, with respect to its impact on nuclear explosive operations and associated activities and facilities. The candidate shall be able to:

A. Discuss the reasons for performing an Unreviewed Safety Question (USQ) determination.

B. Define the following terms:

- Accident analyses
- Safety evaluation
- Technical Safety Requirements

C. Describe the situations for which a safety evaluation is required to be performed.

D. Define the conditions for a USQ.

E. Discuss the actions to be taken if it is determined that a USQ is involved.

F. Discuss the relationship of the USQ process to the NES Change Evaluation Process.

2.2.3 The candidate must have knowledge of the Technical Safety Requirements (TSRs) as described in DOE Order 5480.22, Technical Safety Requirements, with respect to its impact on nuclear explosive operations and associated activities and facilities. The candidate shall be able to:

A. Discuss the purpose of Technical Safety Requirements.

B. Define the following terms and discuss the purpose of each:

- Safety Limit
- Limiting Control Settings
- Limiting Conditions for Operation
- Surveillance Requirements

C. Discuss the conditions that constitute a violation of the Technical Safety Requirements.

D. Discuss the requirements for administrative control of the Technical Safety Requirements.

E. Discuss the possible source documents that may be used in developing Technical Safety Requirements.

2.2.4 The candidate must have knowledge of safety analysis techniques and their application to nuclear explosive operations, facilities, and associated activities. The candidate shall be able to:

A. Describe the following hazard evaluation techniques and the types of results they produce:

- Checklist analysis
- Preliminary hazard analysis
- What-if analysis
- Hazard and operability analysis
- Failure modes and effects analysis
- Fault tree analysis
- Event tree analysis
- Human reliability analysis

B. Describe the bases upon which to judge the adequacy of a hazard evaluation including:

- Thoroughness of hazard identification
- Rigor of analysis versus complexity of operation and potential consequences of accidents
- Conservatism of assumptions
- Applicability of data
- Consistency and control of expert elicitation process
- Validity and conservatism of scenario screening criteria
- Reflection of lack of knowledge in uncertainty estimates

2.2.5 The candidate must have knowledge of DOE Order 5480.23, Nuclear Safety Analysis Reports, with respect to its impact on Department nuclear safety. The candidate shall be able to:

A. Discuss the four basic purposes and objectives of Nuclear Safety Analysis Reports identified in DOE Order 5480.23, Nuclear Safety Analysis Reports.

B Describe the responsibilities of contractors authorized to operate defense nuclear facilities for the development and maintenance of a Nuclear Safety Analysis Report.

C. Define the following terms and discuss the purpose of each:

- Design Basis
- Engineer Safety Features
- Safety Analysis

D. Describe the requirements for the scope and content of a Nuclear Safety Analysis Report and discuss the general content of each of the required sections of the Report.

2.2.6 The candidate must have knowledge of DOE M440.1-1, DOE Explosive Safety Manual. The candidate shall be able to:

A. Discuss the purpose and scope of the Manual.

B. Discuss the applicability of the requirements in this manual to nuclear explosive operations.

2.2.7 The candidate must have knowledge of DOE Order 5480.19, Conduct of Operations Requirements for DOE/NNSA Facilities, necessary to ensure implementation. The candidate shall be able to:

A Discuss the purpose of, and major sections of DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities.

B. Referring to DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities and its attachments, describe the methods of measuring performance.

C. Discuss the concept of graded approach, and how it applies to the implementation of conduct of operations.

D. Discuss 10 CFR 830 and its relationship to the Price-Anderson Act.

E Explain the role of lessons learned to operations, and sources for identifying lessons learned and industry experience.

2.2.8 The candidate must have knowledge of fire protection systems and their effects on nuclear explosive safety. The candidate shall be able to:

A. List the various types of fire protection systems that service nuclear explosive areas and describe the effects of their use on the safety of nuclear explosive operations and associated activities.

B. Discuss the provisions contained in joint DOE/DoD Technical Publication 20-11, General Fire Fighting Guidance, and apply each to a fire situation involving nuclear explosives in DOE custody.

2.2.9 The candidate must have knowledge of facility system interfaces and their potential effects on nuclear explosives. The candidate shall be able to:

A. Identify the facility systems which may interface with a nuclear explosive.

B. Describe the hazards presented to the safety of nuclear explosive operations and associated activities by the introduction of electrical energy sources, or equipment using any electrical source, into a nuclear explosive area.

C. Describe the controls and design measures to prevent or limit the introduction of electrical energy into a nuclear explosive area.

2.2.10 The candidate must have knowledge of the requirements for protection, security, and control of nuclear explosives and nuclear weapons as described in DOE O 452.4, Security and Control of Nuclear Explosives and Nuclear Weapons. The candidate shall be able to:

A. Discuss the objectives of DOE O 452.4, Security and Control of Nuclear Explosives and Nuclear Weapons.

B. Discuss the relationship between NES and deliberate unauthorized use measures.

2.3 General

2.3.1 The candidate must be proficient in technical communications. The candidate shall be able to:

A. Demonstrate proficiency in written communication, including business and technical writing.

B. Demonstrate proficiency in oral communications including briefings, one-on-one presentations, and formal presentations.

C. Demonstrate knowledge of interpersonal communications necessary to effectively communicate, verbally and nonverbally, with DOE management, DOE technical personnel, and all levels of contractor personnel.

2.3.2 (Chairman only) The candidate must have knowledge of DOE M140.1-1A, Interface with Defense Nuclear Facilities Safety Board. The candidate shall be able to:

A. Discuss the scope and purpose of this manual.

B. Discuss this positions role and responsibilities regarding this manual.

2.3.3 (Chairman only) The candidate must have knowledge of problem-solving and decision-making techniques, and the ability to manage activities ensuring that organizational issues are resolved and closed-out in a timely manner. The candidate shall be able to:

A. Identify and discuss the various problem analysis techniques used in the Department.

B. Define the term "root cause" and explain the significance of the term to the safe management of nuclear facilities.

C. Describe the elements of an effective issue management system.

D. Discuss the importance of issues management to safety, quality, and productivity.

E. Discuss the necessary considerations that must be addressed when developing a corrective action.

F. Given the data for an event, determine the root cause and develop corrective actions. Compare the results with that of the originator and discuss any differences.

2.4 Performance Requirements

2.4.1 (Chairman only) The candidate must participate in a minimum of two NESSG activities as an NESSG Chairman-in-training in the three years preceding initial qualification to the requirements in this document. This shall be accomplished as follows:

A. Involvement in all phases of the NESSG activity in order to understand the review process and role of the NESSG Chairman. These phases include; planning meetings, member selection, Adequacy Review, briefings, demonstrations, deliberations, report writing, management briefings, report coordination, and report production process.

B. The candidate is expected to be actively involved in the above phases in order to demonstrate a clear understanding of the roles and responsibilities of a NESSG Chairman. This active involvement includes, reviewing input documentation, questioning briefers, identifying potential safety concerns, engaging in deliberations, drafting findings, and assisting with report coordination and production.

C. For a minimum of one of the required NESSG activities, the candidate shall participate as an NESSG Chairman under instruction (UI). NESSG Chairman UI shall perform duties as a Chairman under the direction of a certified Chairman. This participation shall include all phases of the NESSG activity listed above necessary to demonstrate a clear understanding of and ability to carry out the roles and responsibilities of an NESSG Chairman. This activity shall occur after successful involvement described in A and B.

D. During the activity described in c, the candidate shall lead the NESSG activity under the guidance and direction of the certified NESSG Chairman. The NESSG Chairman shall provide feedback to the candidate regarding performance, and if appropriate document successful completion of this requirement.

E. NESSG Chairman-in-training shall not sign NESSG reports. The certified Chairman acting as a mentor during these activities retains all responsibilities, including signing the report.

2.4.2 (NESSG Member only) The candidate must participate in a minimum of two NESSG activities in the three years immediately preceding final qualification to the requirements in this document. This shall be accomplished as follows:

A. Involvement in all phases of the NESSG activity in order to understand the review process and role of the NESSG Member. These phases include: Adequacy Review, briefings, demonstrations, deliberations, and report writing.

B. For a minimum of one of the required NESSG activities, the candidate shall participate as an NESSG Member-in-training. As a Member-in-training, the candidate is expected to be actively involved in the above phases in order to demonstrate a clear understanding of the roles and responsibilities of a NESSG Member. This active involvement includes, reviewing input documentation, questioning briefers, identifying potential safety concerns, engaging in deliberations, and writing issues.

C. The candidate shall be under the guidance and direction of the certified NESSG Member from the candidate's organization. The certified NESSG

Member and NESSG Chairman shall provide feedback to the candidate regarding performance. If appropriate, the NESSG Chairman will document successful completion of this requirement.

D. NESSG Member-in-training shall not sign NESSG reports.

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CONCLUDING MATERIAL

Review Activity:

DOE
DP
EH
EM
NE
NN

Field Offices
Albuquerque Operations Office
Amarillo Area Office
Kirtland Area Office
Los Alamos Area Office
Nevada Operations Office
Oakland Operations Office

National Laboratories
LANL
LLNL
SNL

Preparing Activity:

DOE-DP-21

Project Number:

SAFT-0074